



Mechanical and Fluid Systems

Full-Size Reduced Gravity Simulator For Humans, Robots, and Test Objects

Reacts Real-Time to Human Impulses Within a Fixed Volume in All Three Dimensions

To train astronauts to live and work in the weightless environment on the International Space Station, NASA employs a number of techniques and facilities that simulate microgravity. Engineers at the NASA Johnson Space Center (JSC) have developed a new system called the Active Response Gravity Offload System (ARGOS) that provides a simulated reduced gravity environment within a confined interior volume for astronauts to move about and/or equipment to be moved about as if they were in a different gravity field. Each astronaut/item is connected to an overhead crane system that senses their actions (walking or jumping, for example) and then lifts, moves, and descends them as if they had performed the action in a specified reduced gravity.

BENEFITS

- ➔ Responsive: Employs fine sensors and motor control that reacts real-time to human impulses and responses.
- ➔ Strong: Handles the weight of a live crewmember in a space suit with ease.
- ➔ Flexible: System able to interface with a wide range of subjects, including humans, robots, and inanimate objects.
- ➔ Cost-Effective: Most of the "big ticket" components are based on commercially available hoist systems.
- ➔ Comprehensive: Offload rate is fully programmable, from 0% (full gravity, no support) to 100% (no gravity, full support, simulating the International Space Station environment), and every percentage inbetween.

technology solution



NASA Technology Transfer Program

Bringing NASA Technology Down to Earth

THE TECHNOLOGY

The Active Response Gravity Offload System (ARGOS) provides a simulated reduced gravity environment that responds to human-imparted forces. System capabilities range from full gravity to microgravity. The system utilizes input/feedback sensors, fast-response motor controllers, and custom-developed software algorithms to provide a constant force offload that simulates reduced gravity.

The ARGOS system attaches to a human subject in a gimbal and/or harness through a cable. The system then maintains a constant offload of a portion of the subjects weight through the cable to simulate reduced gravity. The system supports movements in all 3 dimensions consistent with the selected gravity level. Front/back and left/right movements are supported via a trolley on an overhead runway and bridge drive system, and up/down movements are supported via a precisely positioned cable. The system runs at a very high cycle rate, and constantly receives feedback to ensure the human subjects safety.



ARGOS is able to be used with heavy objects, which are easily moved about by human operators.

APPLICATIONS

The technology has several potential applications:

- The system has many commercial possibilities, wherever individuals have to interact with heavy objects within a confined volume.
- Material handling in a warehouse or Industrial facility
- Physical Therapy
- Commercial shipping/transportation of packages, luggage, or other heavy objects
- Moving vans
- Personal hoist systems for home, office, or garage
- Assembly and maintenance; automotive repair, etc.

PUBLICATIONS

Patent Pending

http://www.nasa.gov/centers/johnson/engineering/integrated_environments/active_response_gravity/

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